

Amendments to and Listing of the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application. Please amend claim 1 and add new claims 2-21 as follows:

1. (Currently amended) A method for ~~determining similarities in images of~~ tissue identifying anomaly regions in a material sample comprising:
 - (a) acquiring pre-deformed images of a ~~tissue~~ material sample;
 - (b) acquiring post-deformed images of the ~~tissue~~ material sample;
 - (c) generating a model ~~and a system~~ having a spatial distribution of properties and that simulates deforming the pre-deformed images of the material sample based upon the pre-deformed and post-deformed images, the model including model-deformed images created by simulating a deformation of the acquired pre-deformed images;
 - (d) calculating, using a similarity metric, a change in regional ~~mutual information based upon~~ similarity between the model model-deformed images and the acquired post-deformed images;
 - (e) optimizing the model by determining how the similarity calculated in step (d) changes with respect to changes in the spatial distribution of properties, and subsequently adjusting the model, including the spatial distribution of properties, to improve the similarity between the model-deformed images and the acquired post-deformed images; selecting and perturbing a property in the model in order to solve the system; and
 - (f) iteratively repeating steps (d)-(e) a predetermined number of times or until a prescribed condition regarding the quality of the model is met; and
 - (g) identifying elasticity anomaly regions within the tissue material sample utilizing the solved-system optimized model.

2. (New) The method according to claim 1, further comprising:

(h) producing an output that includes a stiffness image based upon the optimized model which consequently optimizes the similarity between the model-deformed images and the acquired images.

3. (New) The method according to claim 2, wherein the output includes a series of stiffness images.

4. (New) The method according to claim 1, wherein the predetermined number of times is two or more.

5. (New) The method according to claim 4, wherein the predetermined number of times is restricted when the calculated change in regional similarity between the model-deformed images and the acquired post-deformed images is within a predetermined error tolerance.

6. (New) The method according to claim 4, wherein the predetermined number of times is between approximately five and thirty.

7. (New) The method according to claim 1, wherein the material sample includes a tissue sample.

8. (New) The method according to claim 7, wherein the tissue sample includes breast tissue.
9. (New) The method according to claim 1, wherein the model is based on one of an elastic model, a viscoelastic model, and a hyperelastic model.
10. (New) The method according to claim 1, wherein the model is based on any model that accurately represents the deformation behavior of any material.
11. (New) The method according to claim 1, wherein the model is based on finite element analysis including initial and boundary conditions.
12. (New) The method according to claim 1, wherein step (e) includes a plurality of properties.
13. (New) The method according to claim 1, wherein the properties include material properties.
14. (New) The method according to claim 1, wherein the pre-deformed images of the material sample are acquired using one of magnetic resonance imaging, computed tomography imaging, ultrasound imaging and optical imaging.
15. (New) The method according to claim 1, further comprising:

(h) measuring the elastic properties of the material sample utilizing the optimized model; and

(i) identifying elasticity anomaly regions within the material sample utilizing the optimized model.

16. (New) The method according to claim 1, wherein the spatial distribution of properties of the model is based upon a Jacobian matrix whereby each column of the Jacobian matrix represents the change in regional image similarity with respect to each perturbed material property of the model.

17. (New) The method according to claim 1, wherein steps (d)-(f) utilize a Levenberg-Marquardt approach to iterative optimization.

18. (New) The method according to claim 1, wherein the optimizing of step (d) includes selecting and perturbing a property in the spatial domain.

19. (New) A method for measuring the elastic properties of a material sample comprising:

(a) acquiring a source image of a pre-deformed material sample;

(b) acquiring a target image of a post-deformed material sample;

(c) generating a model having a spatial distribution of properties and that simulates deforming the source image of the material sample based upon the source and target images, the model including a model-deformed image created by simulating a deformation of the acquired source image;

- (d) calculating, using a similarity metric, a change in regional similarity between the model-deformed image and the target image;
- (e) optimizing the model by determining how the similarity calculated in step (d) changes with respect to changes in the spatial distribution of properties, and subsequently adjusting the model, including the spatial distribution of properties, to improve the similarity between the model-deformed image and the target image;
- (f) iteratively repeating steps (d)-(e) a predetermined number of times or until a prescribed condition regarding the quality of the model is met; and
- (g) identifying elasticity anomaly regions within the material sample utilizing the optimized model.

20. (New) An article of manufacture for identifying anomaly regions in a material sample, the article of manufacture comprising a computer-readable medium holding computer-executable instructions for performing a method comprising:

- (a) acquiring pre-deformed images of a material sample;
- (b) acquiring post-deformed images of the material sample;
- (c) generating a model having a spatial distribution of properties and that simulates deforming the pre-deformed images of the material sample based upon the pre-deformed and post-deformed images, the model including model-deformed images created by simulating a deformation of the acquired pre-deformed images;
- (d) calculating, using a similarity metric, a change in regional similarity between the model-deformed images and the acquired post-deformed images;
- (e) optimizing the model by determining how the similarity calculated in step (d) changes with respect to changes in the spatial distribution of properties, and subsequently adjusting the model, including the spatial distribution of properties, to

improve the similarity between the model-deformed images and the acquired post-deformed images;

(f) iteratively repeating steps (d)-(e) a predetermined number of times or until a prescribed condition regarding the quality of the model is met; and

(g) identifying anomaly regions within the material sample utilizing the optimized model.

21. (New) An article of manufacture for measuring the elastic properties of a material sample, the article of manufacture comprising a computer-readable medium holding computer-executable instructions for performing a method comprising:

(a) acquiring a source image of a pre-deformed material sample;

(b) acquiring a target image of a post-deformed material sample;

(c) generating a model having a spatial distribution of properties and that simulates deforming the source image of the material sample based upon the source and target images, the model including a model-deformed image created by simulating a deformation of the acquired source image;

(d) calculating, using a similarity metric, a change in regional similarity between the model-deformed image and the target image;

(e) optimizing the model by determining how the similarity calculated in step (d) changes with respect to changes in the spatial distribution of properties, and subsequently adjusting the model, including the spatial distribution of properties, to improve the similarity between the model-deformed image and the target image;

(f) iteratively repeating steps (d)-(e) a predetermined number of times or until a prescribed condition regarding the quality of the model is met; and

(g) identifying elasticity anomaly regions within the material sample utilizing the optimized model.